REMARKS

A. The Preliminary Amendment

Claims 31 – 72 are now pending in the present application. Original PCT Claims 1 – 30 have been canceled. Claims 31 – 72 are new claims which have been substituted for original PCT Claims 1 – 30 to more clearly distinguish over the prior art cited in the International Search Report (ISR). No new matter has been added. Each of the new claims is clearly supported by the application as originally filed. On request by the Examiner, Applicants agree to promptly identify the support in the Specification for any new claim or portion thereof.

Entry of this Preliminary Amendment is respectfully requested. It is further requested that the filing fee calculation for this application be based on the new set of claims 31 – 72 submitted herein.

B. Adding Alternative Units of Measurement

The original Specification and Claims defined the UV laser light wavelengths of this invention is "nm" units. To better distinguish over the prior art cited in the International Search Report (ISR), this Preliminary Amendment amends the Specification and claims to also recite the UV laser light wavelengths of this invention in the alternative units of measurement "cm^{-1}." Because this represents a direct and familiar conversion of one unit of measurement to the mathematically equivalent alternative unit of measurement, no new matter has been added by this amendment.

C. The Claims Clearly Distinguish Over the ISR References

The International Search Report, Written Opinion and Preliminary Examination Report in the corresponding PCT application cited and applied three U.S. patent references: U.S. Pat. Nos. 3,941,670 (Pratt '670); 5,120,450 (Stanley '450); and 5,144,146 (Wekhof '146). The claims now pending in this application clearly distinguish over these three references, whether viewed individually or in combination.

1. Pratt '670

Pratt '670 was cited for its teaching of a method of altering (i.e., deactivating or activating) the biological activity of macromolecular species by employing "laser beam radiation at a frequency that excites vibrational and rotational states of the irradiated species...." (see Abstract of Pratt '670). The range of useful laser beam radiation frequencies taught by Pratt '670 is 350 cm^{-1} to 3500 cm^{-1} (see, e.g., Claim 6 of Pratt '670). This range was not selected arbitrarily: it is based on the "Raman spectra of many amino acids, nucleic acids, and biopolymers...." (col. 1, lines 45-49 of Pratt '670).

In contrast to the present invention, however, Pratt '670 teaches nothing whatsoever about decomposing chemical compounds, whether organic or inorganic. Pratt '670 talks about "activating" or "deactivating" certain types of organic molecules, not about destroying those compounds. Furthermore, Pratt '670 uses an irradiation range that is generally regarded as being in the infrared portion of the light spectrum, far from the ultraviolet laser light used by the present invention. Indeed, there is an entire order of magnitude difference between the light frequency range of Pratt '670 (350 cm^{-1} to 3500 cm^{-1}) and the UV laser light range (55,560 cm^{-1} to 25,000 cm^{-1}) taught and claimed in this application.

2. Stanley '450

Stanley '450 was cited for its teaching of a fluid decontamination apparatus that utilizes a combination of high intensity, directed ultraviolet radiation and oxidation. Stanley '450 teaches using ultraviolet light at a particular wavelength of 254 nm, and goes to great lengths to produce UV light at this precise wavelength (see, e.g., col. 4, lines 44-59 of Stanley '450).

Even with UV light at 254 nm, however, Stanley '450 teaches that "the presence of an oxidant" is still required "for promoting the oxidation of organic contaminates" (col. 4, lines 59-62). The oxidants taught by Stanley '450 are hydrogen peroxide and ozone (col. 3, lines 63-65). As taught by subparagraph (d) of Claim 8 of Stanley '450, the presence of an oxidant is necessary for operation of this system because the oxidant creates hydroxyl radicals "resulting in organic molecular disassociation."

By contrast, the methods and apparatus of the present invention do not require the addition of an oxidant to the aqueous solution being treated for removal of contaminants. This leads to important process and reagent efficiencies, added process/apparatus simplicity and flexibility, and resultant cost savings. Nothing in Stanley '450 suggests that there is any way to effectively carry out the Stanley '450 process without addition of an oxidant. Furthermore, Stanley '450 also fails to teach or suggest the particular energy densities, pulse rates, and other important process parameters as recited in the present claims.

3. Wekhof '146

Wekhof '146 was cited for its teaching of a method for destruction of toxic compounds through direct ultraviolet irradiation. Although Wekhof '146 teaches using UV light in a wavelength range of 175-300 nm, it is clear that Wekhof '146 uses UV lamp light,

not UV laser light (see, e.g., col. 3, line 62). Thus, the average power density in Wekhof '145 is maintained at a value "of about 0.1 Watt/cm^2" (col. 4, lines 7-8), or "0.5 Watt/cm^2" (Abstract), both of which are at least an order of magnitude smaller than the power densities used in the present invention.

In addition, none of the three ISR references teach anything about the claimed methods for monitoring the progress of the contaminant decomposition process according to this invention. Also, none of the three ISR references teach or suggest treatment methods that result in substantially complete decomposition of contaminating substances in an aqueous solution in the very short treatment times of this invention; and, there is no basis for anyone to believe that such results are even possible apart from the teachings of this invention.

SUMMARY AND CONCLUSIONS

For all of the foregoing reasons, Applicants respectfully submit that Claims 31 – 72 now pending are patentable over the prior art of record, and an early Notice of allowance is earnestly requested.

Respectfully submitted,

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